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(12) **United States Patent**
Chowdhury et al.

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(54) **MODIFYING FUNCTIONALITY OF AN ELECTRONIC DEVICE DURING A MOISTURE EXPOSURE EVENT**

(58) **Field of Classification Search**

CPC G06F 3/0418; G06F 3/0414; G06F 3/044;
G06F 3/0412; G06F 1/1656;

(Continued)

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(56) **References Cited**

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U.S. PATENT DOCUMENTS

6,730,863 B1 * 5/2004 Gerpheide G06F 3/044
178/18.02
8,717,331 B2 * 5/2014 Kremin G06F 3/0418
345/174

(Continued)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

FOREIGN PATENT DOCUMENTS

CN 106357935 A 1/2017
CN 105339877 B 9/2018
WO 2015088453 A1 6/2015

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(57) **ABSTRACT**

(65) **Prior Publication Data**

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This application relates to an electronic device that includes a processor and a display assembly overlaid by a protective cover. The display assembly can include a touch detection system capable of detecting a touch event at the protective cover. The touch detection system can include a capacitance detector capable of detecting a change in capacitance and a location corresponding to the change in capacitance, and an applied force detector capable of detecting an amount and a location of a force applied to the protective cover that is associated with the touch event. The electronic device can include a moisture detector capable of detecting an amount of moisture present at the protective cover, where when the amount of moisture is greater than a threshold amount, the processor determines a position of the touch event based on detection signals provided by the capacitance detector and the applied force detector.

Related U.S. Application Data

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G01N 27/22 (2006.01)
G06F 3/041 (2006.01)

(Continued)

(52) **U.S. Cl.**
CPC **G01N 27/223** (2013.01); **G03B 17/08** (2013.01); **G06F 1/1626** (2013.01);
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17 Claims, 18 Drawing Sheets

